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ABSTRACT OF THE DISCLOSURE

A tunable multi-zone injection system for a plasma processing system for plasma processing of substrates such as semiconductor wafers. The system includes a plasma processing chamber, a substrate support for supporting a substrate within the processing chamber, a dielectric member having an interior surface facing the substrate support, the dielectric member forming a wall of the processing chamber, a gas injector fixed to part of or removably mounted in an opening in the dielectric window, the gas injector including a plurality of gas outlets supplying process gas at adjustable flow rates to multiple zones of the chamber, and an RF energy source such as a planar or non-planar spiral coil which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state. The injector can include an on-axis outlet supplying process gas at a first flow rate to a central zone and off-axis outlets supplying the same process gas at a second flow rate to an annular zone surrounding the central zone. The arrangement permits modification of gas delivery to meet the needs of a particular processing regime by allowing independent adjustment of the gas flow to multiple zones in the chamber. In addition, compared to consumable showerhead arrangements, a removably mounted gas injector can be replaced more easily and economically.